Advanced Metering Infrastructure – AMI – is a fundamental part of the grid's evolution

Retail electricity landscape is becoming more and more complex, with the demands and expectations of all market participants continuing to grow. As the industry attempts to deal with the challenges – and maximize the opportunities – associated with this transition, it has begun to seek technology-enabled solutions designed to better engage customers. ENGIE Resources has been at the forefront of this effort with our Energy Revolution initiative, which focuses on providing the individuals and businesses we serve with the tools and resources they need to help reduce bills, ensure a secure supply, and mitigate the carbon footprint of electricity generation.

As part of this trend, the utility industry too, is redefining itself as a more customer-centric service sector whose traditional structure – the generation, transmission, and distribution of electricity – is also undergoing a profound change. The new model seeks in part to foster improved communication between providers and end users through innovative technologies that encourage customers to make better, smarter decisions not only about what they pay for power, but also about when and how they consume that power.

Advanced Metering Infrastructure – AMI, an integrated system of smart meters, communications networks, and data management systems – is a fundamental part of this system's evolution.

Despite its importance in the enabling of this transformation, deployment of AMI smart meters has varied by state, utility, and ISO/RTO. Installations surged from 2009 to 2012, though there is some disagreement as to whether growth in the North American market today has slowed or even flattened altogether. But

while some of the statistics and analyses may conflict, there is consensus that smart meters are becoming what the Edison Foundation has called "the new business as usual" for utilities, adding:

Electric companies across the U.S. are leveraging smart meter data to better monitor the health of the energy grid, more quickly restore electric service when outages occur, integrate distributed energy resources, deliver energy information to customers, and provide smart pricing options to customers.

Smart Meters: The Benefits Of Data

As noted above, the ongoing energy transition is in no small part a function of innovative technology that gives customers a central role in the electricity equation. AMI enables this process. Smart meters allow businesses and individuals to better manage their consumption and benefit from the cost savings that come from time-based rate offerings. They provide highly detailed information that gives customers a better understanding of their usage patterns, enabling them to make better decisions about how much and when they use power. They can give providers customer-specific information that will help them develop customer-specific products and services. And by reducing consumption, they can also reduce the need for expensive new infrastructure; avoid the use of older, less efficient plants; ease stress on the grid; and lessen the environmental impact of generation.

This represents another shift away from the current system. Rather than focusing on kilowatts as a commodity, smart meters focus on the value of data as a commodity. Under the current model, a traditional scalar meter measures the aggregate number of kilowatts consumed monthly, and that total is then profiled to the hourly level using a generic shape developed by the utility based on an average of usage consumption patterns. But this focus on kilowatts is price-centric and ignores the socio-environmental benefits that customers can bring to the equation. With AMI, however, customers have the kind of information that enables them to settle on their actual usage on an hour-by-hour basis. This, in turn, gives them the ability to decide to use less power when it's more expensive, adjust consumption based on their own personal habits, or reduce consumption entirely. The availability of this data meets the imperatives of the new energy economy – and the ENGIE Energy Revolution – by helping to manage price and usage and, by extension, delivering socio-economic benefits such as lower bills and fewer emissions from fossil fuel-burning power production.

SMART METER (AMI)
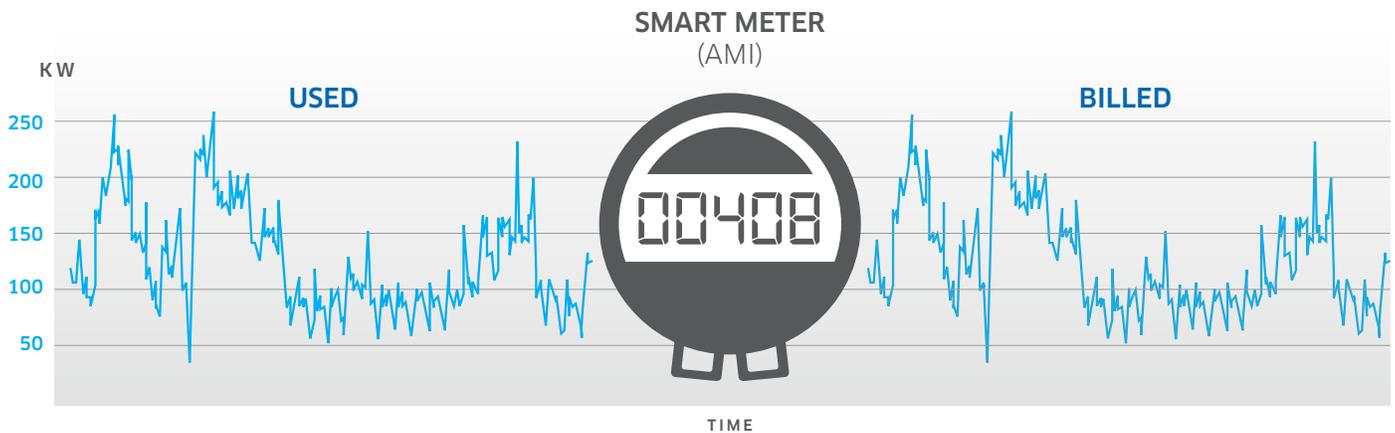
Consumer is billed based on actual hourly (or 15-minute interval) consumption and has the power to impact their bill by changing behavior and introducing smart IoT technologies.

SCALAR (or AMR) METER
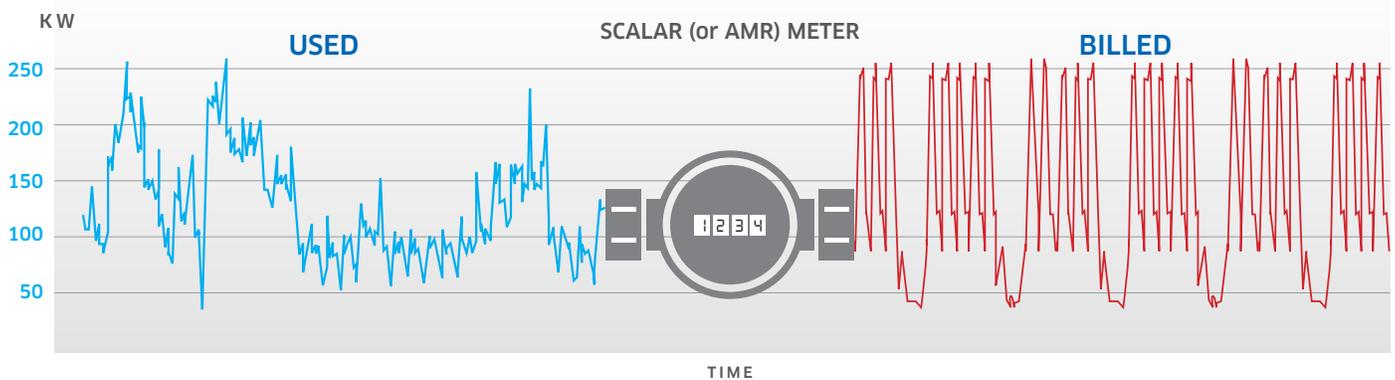
Consumer is billed based on profiled consumption (monthly total remains the same) and has very limited power to implement change. Consumer actually may be hurt if ToU pricing is implemented and the majority of their consumption is in the weekend.
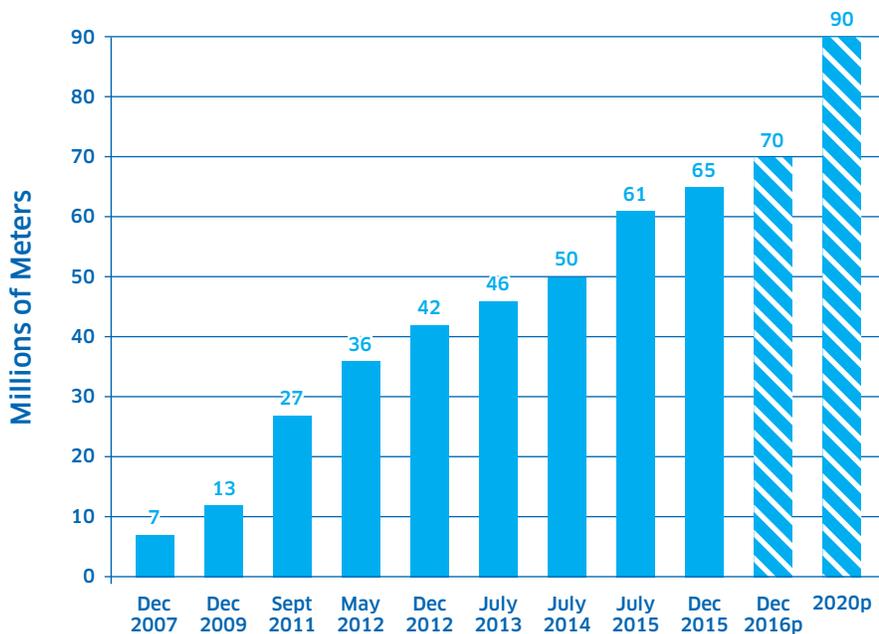
Overview Of The Current Climate

According to the most recent figures from the U.S. Energy Information Administration, issued in December 2016 based on data from 2015, a total of 64,743,832 smart meters have been installed. The breakdown is as follows:

57,107,786	7,324,345	310,889	813

A report from the Edison Foundation put the total 2015 installation figures slightly higher, at 65,572,000. It also noted that the largest investors in smart meter technology are investor-owned utilities, which at the end of 2015 had installed 49.5 million AMIs and were forecast to add more than 3 million in 2016. Municipal utilities and electric co-operatives installed 16.1 million in 2015 and were projected to bring on another 1.1 million in 2016. Overall, smart meter deployment is estimated to reach 90 million by 2020, Edison said.

Globally, Navigant Research noted that Western Europe is "no stranger" to smart meters, driven greatly by the European Union's goal to replace 80 percent of electricity meters with smart technology by 2020 (amounting to 200 million smart meters). Italy and Sweden are seen as leading the movement, with large-scale rollouts planned by Denmark, Finland, France, Spain, the United Kingdom, The Netherlands, and Greece. In the Asia-Pacific region, China is expected to complete a huge smart meter rollout by the end of this year, though the success of the market may ultimately rest with India by virtue of its size and ambitious smart meter targets. At the end of 2016, an estimated 700 million smart meters had been installed, half of them in China.

Western Europe is "no stranger" to smart meters, driven greatly by the European Union's goal to replace 80 percent of electricity meters with smart technology by 2020 (amounting to 200 million smart meters).

Bar chart — Millions of Meters:
- Dec 2007: 7
- Dec 2009: 13
- Sept 2011: 27
- May 2012: 36
- Dec 2012: 42
- July 2013: 46
- July 2014: 50
- July 2015: 61
- Dec 2015: 65
- Dec 2016p: 70
- 2020p: 90

Rates of penetration have varied by state, utility, and market. Nevertheless, installations have been rising overall since 2007, and in 2013, for the first time in history, the number of AMI smart meters surpassed the number of traditional meters.
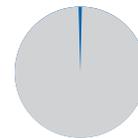
Installations By ISO/RTO, State, And Utility

Smart meter deployment in the United States is a function of multiple factors, including private sector investments, regulatory commission policies and approval, government-provided financial assistance, and utility business models. As such, rates of penetration have varied by state, utility, and market. Nevertheless, installations have been rising overall since 2007, and in 2013, for the first time in history, the number of AMI smart meters surpassed the number of traditional meters.
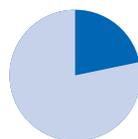
Following is a breakdown of smart meter deployment by a sampling of ISO/RTOs in the **deregulated** markets and territories, based on the most current data available. The first number represents the number of smart meters installed; the second number reflects the amount of power they represent:
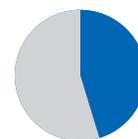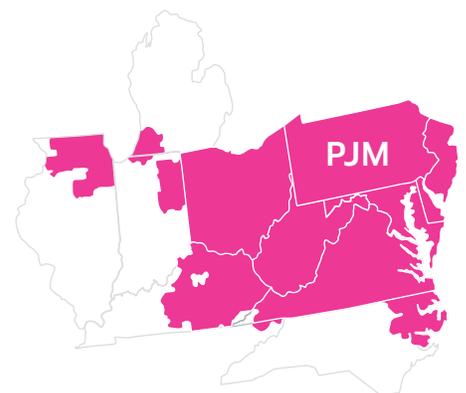
ERCOT
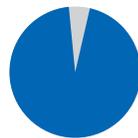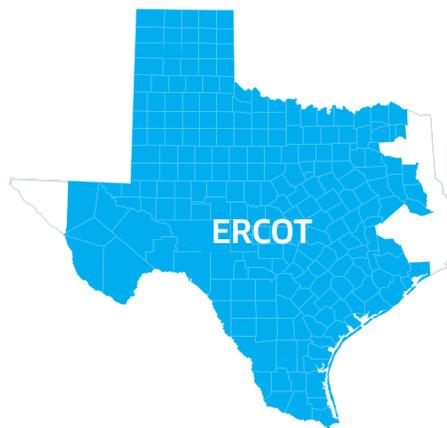
7,593,032 installed
153.5 TWh served

NYISO

19,484 installed
13 TWh served

ISO-NE

1,167,764 installed
14.9 TWh served

PJM

10,173,224 installed
201.1 TWh served

ONCOR

3,424,551

ComEd	CenterPoint Energy	PECO	ppl
3,035,314	**2,412,590**	**1,649,497**	**1,428,614**

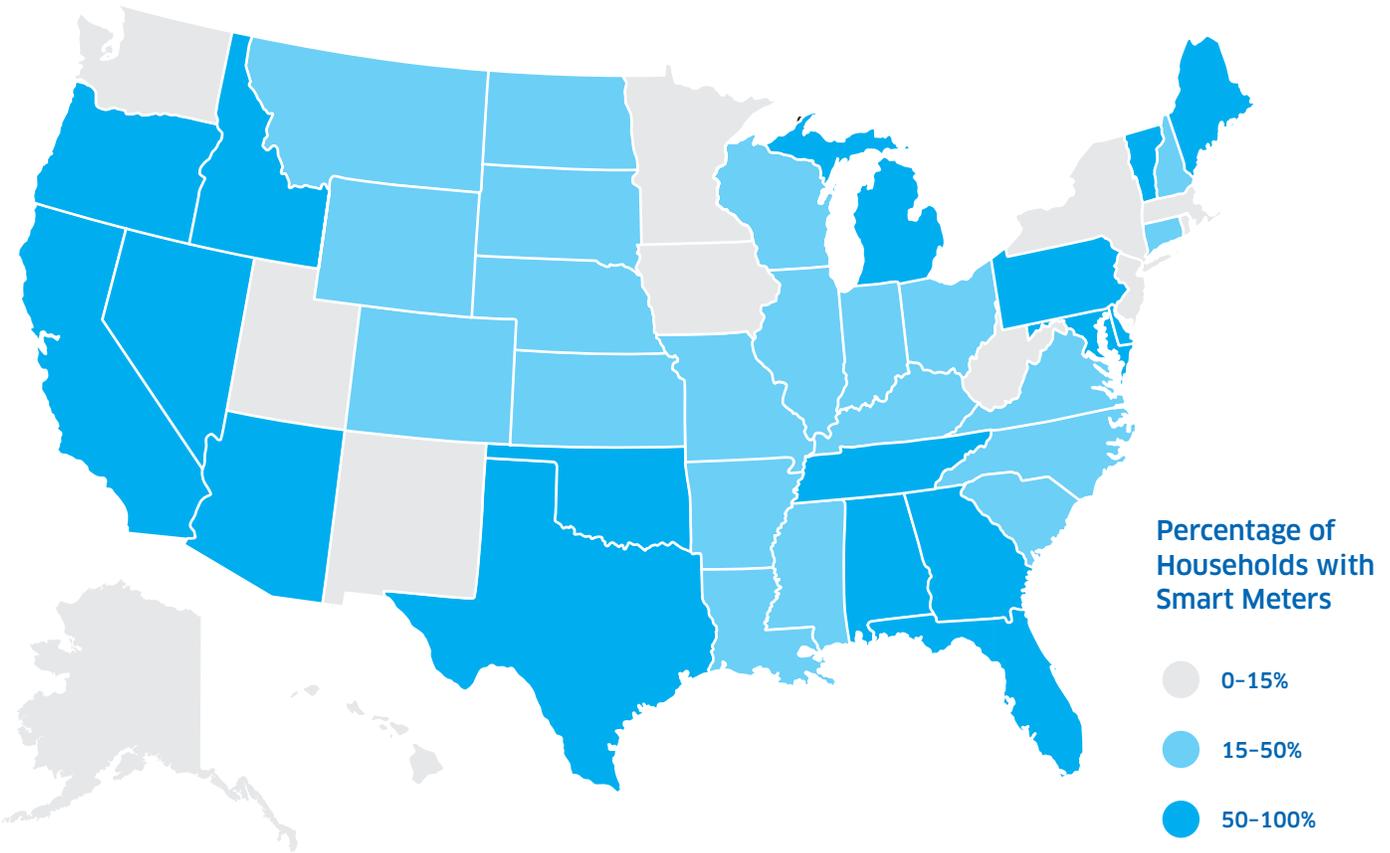| BGE	AEP TEXAS	DUKE ENERGY	Ameren ILLINOIS	DLC DUQUESNE LIGHT CO.
1,244,053	**833,454**	**709,430**	**423,585**	**329,889**

A closer examination of the data from the markets identified above provides a deeper look at the status and successes of some smart meter installations:

Percentage of Households with Smart Meters

- 0–15%
- 15–50%
- 50–100%

Baltimore Gas & Electric had installed more than 1.2 million smart meters through the end of 2016, for a deployment rate of more than 95 percent. PEPCO and Delmarva Power (Maryland) are at 100 percent deployment.

There are no active smart meter projects in New Jersey.

National Grid's smart meter pilot project was approved by the state in 2012, and 1.3 million are forecast to be installed by 2020. The Massachusetts DPU mandated that the state's six largest utilities install smart meters as part of their 10-year grid modernization plan.

The state of Maine completed its smart meter deployment in 2012 and now has 750,000 installations.

While Consolidated Edison has less than 5,000 smart meters in the field, it plans to deploy 3.6 million by 2021. Orange & Rockland Utilities will deploy 400,000 smart meters across its territory in 2017.

PA Act 129 requires EDCs with 100,000+ customers to install AMI tech. PPL has fully deployed over 1.4 million smart meters in its market.

Duke Energy has fully deployed 717,000 meters in its Ohio markets. AEP Ohio has deployed 136,000 AMI meters in the Columbus area and has filed with state regulators to install an additional 900,000.

AEP Texas, Centerpoint, and Oncor have reached full deployment.

Forecasts On Installation Growth

Smart meter growth from 2009 to 2012 has been widely credited to the U.S. Department of Energy's Smart Grid Investment Grant Program, which sought to speed the modernization of U.S. transmission and distribution systems. Although the program contributed to a surge in installations, Navigant research noted in a 2016 report that fewer project announcements have occurred since 2013 – a development *Electric Light & Power* said demonstrated that the North American smart meter market had "plateaued." It added that a handful of scheduled deployments, such as that from Con Ed, were essentially keeping overall activity afloat.

On the other hand, the Federal Energy Regulatory Commission in December 2016 issued its own report that concluded: "Deployment of advanced meters continues to increase throughout the country, and advanced meters are the predominant metering installed and operational in the United States." It further noted that advanced meter penetration had risen from 4.7 percent of total meters in the commission's 2008 survey to 40.6 percent in 2014.

Interestingly, a research associate with Navigant wrote in November 2016 – just months after the firm's report about the "plateauing" North American market – that smart meter penetration will continue to grow, crossing the 50 percent milestone in 2024 and rising to 53 percent the following year. He added that smart meter revenue is expected to increase from $8.8 billion in 2016 to more than $10.7 billion in 2025.

> Interestingly, a research associate with Navigant wrote in November 2016 – just months after the firm's report about the "plateauing" North American market – that smart meter penetration will continue to grow, crossing the 50 percent milestone in 2024 and rising to 53 percent the following year.

"In the end, smart meters give customers the power to orchestrate their own usage and help put them at the center of the energy system."

Conclusions

Despite somewhat differing assessments of where smart meter installations may go in the future, it seems likely that their impact on the power system will grow. State regulators have recognized their importance to grid modernization, and more and more utilities are undertaking or planning smart meter initiatives.

In a February 2016 report, the Pew Charitable Trusts captured the benefits that smart technologies, as exemplified by smart meters, can deliver to customers, signaling that they will play a greater rather than a lesser role in the U.S. energy future:

The availability of additional information is also changing the behavior of many industrial, commercial, and institutional energy users. Having access to real-time demand and price data helps end users make more informed decisions on energy use and consumption to optimize their resources. Large-scale power users who make electricity using distributed resources can decide whether to use the energy they generate or sell it back to the grid, taking advantage of real-time pricing. Further, as more improved technologies come online, smart grid devices will allow owners of energy storage equipment to capitalize on the power they are holding. As technology continues to evolve, the meters will be the jumping-off point to an entirely new definition of "choice," in which customers will employ "Internet of Things" devices and systems such as AMI to help them decide whether they want to use electricity as it is generated at the point of consumption, sell excess power, store it for personal use or for sales later, or shift from self-generation to grid-supply generation. As this transition unfolds, the retail provider of today will have to evolve into a different kind of company tomorrow, embracing customer-centric strategies that shape a better world through innovation. In the end, smart meters give customers the power to orchestrate their own usage and help put them at the center of the energy system.